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19. 4 A.M.; 6 A.M. (lasted 5 min.); 8½ to 10½, with short intervals of intermission; 2½ P.M. (½ hr.); 8 P.M. (½ hr.); 12 P.M.
20. 10 A.M. (lasted ½ hr.); 2½ P.M. (1 hr.); 6 to 7 P.M., with short intervals.
21. 3 A.M.; 8 A.M. (lasted ¼ hr.); 9 to 10½, with abatements; 3 to 4 P.M., ditto; 7 to 9 P.M., ditto.
22. 6 A.M. (lasted 1 hr.); 10 to 12 A.M., with intervals; 3 to 4 P.M., ditto; 7 to 9 P.M., ditto.
23. 6 A.M. (lasted ½ hr.); 10½ to 12 A.M., with intervals; 4 P.M.; 8½ P.M.
24. 6 A.M. (lasted 1 hr.); 10 A.M. (1 hr.); 3·45 P.M., with great violence; 8 P.M. (1 hr.)
25. 6 A.M. (lasted 1½ hr.); 10½ A.M. (1 hr.); 3·15 P.M. (1 hr.); 8 P.M. (1 hr.); 12 P.M.
26. 3 A.M.; 6 A.M. (lasted ½ hr.); 9½ P.M. (½ hr.); 3 P.M.; 8 P.M. (1 hr.).
27. 5½ A.M. (½ hr.). Left Atami.

Note.—There is said to be an interval of rest either at new moon or full, and the landlord of the hoien said he had kept a book for a long period, noting the ebullitions every day, which would show this. It could not be found at the moment, and was sent after me two or three weeks after my return to Yeddo; but it had all the appearance of having been made up merely to send me, and, with some experience how little trust can be placed in Japanese conscientiousness, I confess I put no faith in its authority or accuracy. The sources are said to show greater or less activity with ejection of steam and pumping of water at six periods in the 24 hours; at 6, 10, and 3 o'clock, twice repeated. But as will be seen by the few days' diary, there is considerable irregularity, although so many times each day, and at those hours more frequently than at any others.

APPENDIX.

XXIV.—*First Ascent of the Tian-Shan or Celestial Mountains, and Visit to the Upper Course of the Jaxartes or Syr-Daria, in 1857.* By P. P. SEMENOF, Fellow of the Imperial Russian Geographical Society. (Translated from the Russian, by JOHN MICHELL, Esq.)

THE skeleton of the continent of Asia is formed by four gigantic and almost parallel mountain-ranges, severally known as the Altai-Sayan, the Tian-Shan, the Kuen-Lun, and Himalayan.

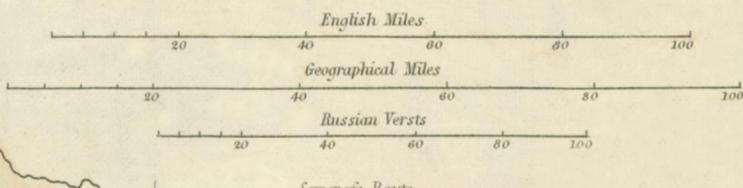
Only two of these systems—the most northerly or Altayan, and the most southerly or Himalayan—have as yet been explored, the former from Siberia by Russian men of science and travellers, the latter by English expeditions from India. The Tian-Shan and Kuen-Lun, situated in the interior of the largest continental mass of the terrestrial globe—the one in 42°, the other in 36° of northern latitude—have hitherto been inaccessible to European scientific travellers. At the same time these gigantic mountain-chains which rise from the zone of apricot and granate trees, of rice and of cotton, far beyond the limit of perpetual snows, are perhaps of greater scientific interest than the interior of Africa, with which we are now somewhat acquainted through the bold explorations of Barth, Fogel, Livingstone, and others.

Numerous historical events of remote antiquity connected with the interior of the Asian continent—that cradle of so many tribes and nationalities—could naturally have contributed some information to geographical science, and these testimonies of history have been fully investigated by Klaproth, Ritter, and Humboldt.

Klaproth was the first to show that the Tian-Shan and Kuen-Lun were totally distinct and independent ranges; Ritter systematically arranged and

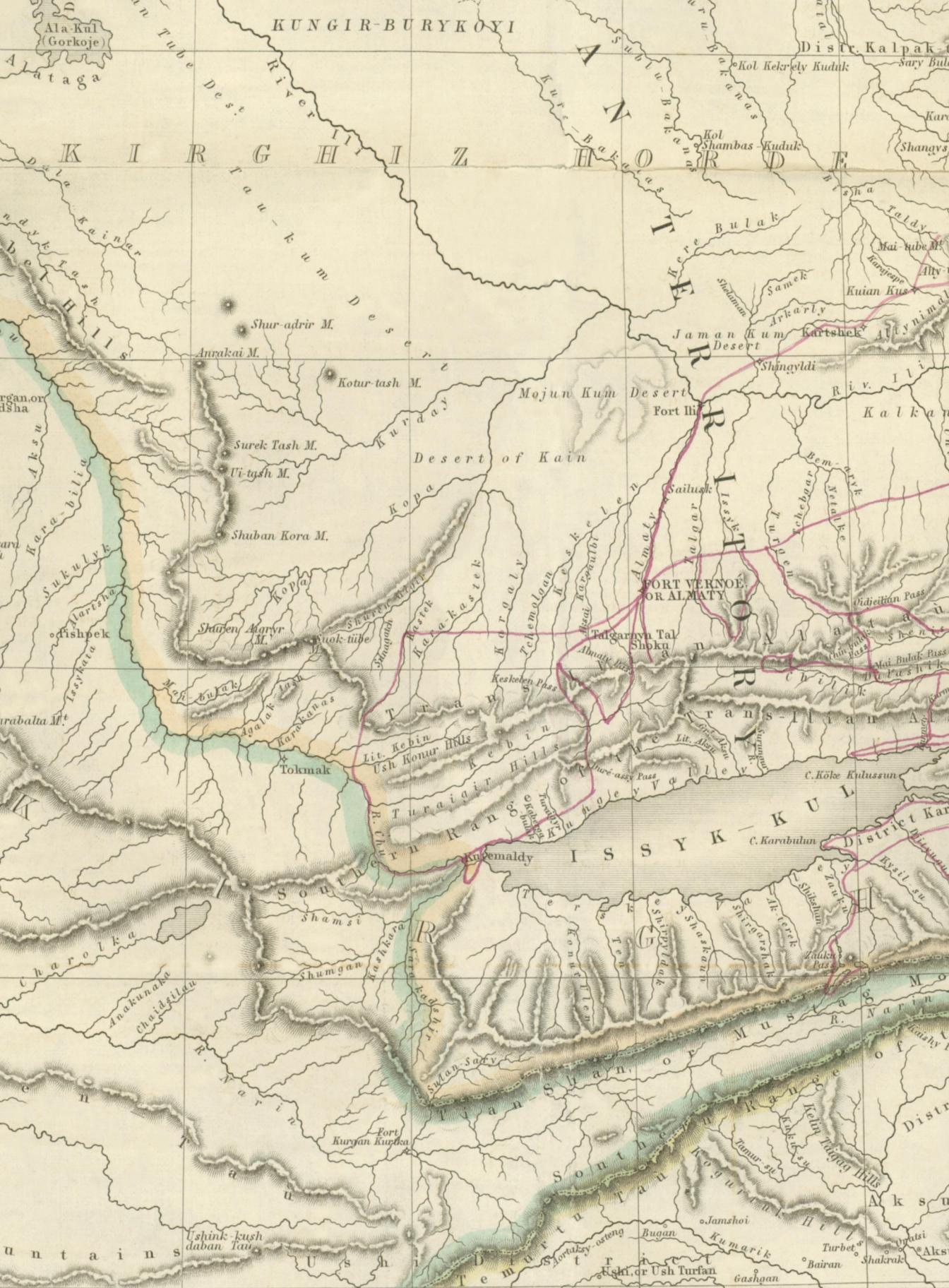
MAP OF THE
RUSSIAN & CHINESE FRONTIER

Illustrating the Journey of
Semenof to the Tian-Shan Mountains & R. Jaxartes
& Golubef's Issyk-kul Expedition.











critically elaborated all the facts relating to the geology of the interior of Asia, and particularly with reference to the Tian-Shan; while Humboldt described with learned minuteness the general features of the orographical formation of the country. But the facts thus investigated by the most eminent scientific men of this age were meagre and insufficient; they had only been casually supplied by men who had travelled without any scientific object, or by such strangers to science as Chinese travellers and Buddhist missionaries of the 16th and 17th centuries. The Chinese commission of the 18th century which, under the guidance of Jesuit missionaries, made a cartographical survey of the Si-Yui or western country, and even determined astronomically a point on the lake of Issyk-kul, was the only approach that had been made to anything like a scientific exploration. Nor have the Jesuits, to my knowledge, left any personal account of their travels in the vicinity of the Tian-Shan; and their maps, except the points astronomically fixed, are founded on the dry and verbal itineraries of their Chinese assistants. Consequently our acquaintance with the orography and geology of the mountain-systems of Inner Asia has hitherto been of a very limited nature. Humboldt has very aptly compared it to the state of our knowledge of the geology of the moon.

Encouraged by Humboldt, and furnished with means by the Imperial Russian Geographical Society, I proceeded, in 1857, to explore the Tian-Shan and upper course of the Syr-Daria.

The lake Balkhash, and the deep hollow which connects it with Ala-kul Lake, its dried-up extremity, separate the mountain-systems of Central Asia from the uniform Kirghiz Steppe, which only occasionally rises in very low mountain-groups. A change of scenery, therefore, the more appreciable from its sudden richness and beauty, awaits the traveller, who, passing between the lakes of Balkhash and Ala-kul, gains the summit of the low and isolated group of the Arganatin hillocks, situated to the north-east of the mouth of the river Lepsa. And while to the west of these elevations the landscape fades out of sight in the silvery surface of Lake Balkhash, and the arid evenness of the plain beyond, on the south-east the eye is dazzled by the whiteness of the snow-clad mountains, which, towering to the skies, extend in bold outline from north-east to south-west. This mountain-system is called the Alataù; and to distinguish it from other ranges of the same name, it will be designated throughout this Paper as the Djungarian Alataù, from its having been in the 18th century the bulwark of the flourishing kingdom of Djungaria.

This mountainous region, visited between the years 1840 and 1851 by the Russian travellers Karelin, Schrenk, Kovalevsky, and Vlangali, is separated and sharply defined on the north by the depressed zone of Balkhash and Ala-kul, on the south by the low and broad valley of the Ili, while on the east it is connected with Bogdo-Ula, the most elevated knoll of the Tian-Shan system. This mountainous surface is formed by the intersection of two axes of elevation, one of which, the Iren-Habirgan, extends straight from east to west, parallel to the Tian-Shan, with which it is connected by the Bogdo Knoll; while the other, or Alataù proper, stretches from north-east to south-west, intersecting the former at a sharp angle. The axis of elevation of the Iren-Habirgan forms, to the west of its intersection with the Alataù, several parallel chains, between which, at an absolute height of 3000 feet, on a fertile and well-watered plateau, stands the town of Kopal, a flourishing Russian settlement, established in 1847, for the protection of the great Kirghiz horde against the bold inroads of the Dikokamanni Kirghizes. Another equally flourishing agricultural settlement, though only founded in 1855, is situated on the valley of the principal axis of the Djungarian Alataù, at the upper course of the river Lepsa, at an elevation of 2400 feet. High above the valleys rise the snowy summits of the Djungarian Alataù, whose mean elevation I determined at 6000 feet above the level of the sea, while, according to Schrenk, the limit of their altitude may be taken at 12,000 feet. The perpetual snows

of the Djungarian Alataù, and particularly those on the north-western slopes of that range, give rise to innumerable rapid and turbulent streams, which carry irrigation and fertility to the picturesque valleys and plains below—the latter being called the Semirechinsk region, from the seven rivers fed by these mountain-torrents. It is only on the west, in the direction of Lake Balkhash, that the Semirechinsk region merges gradually into a sandy and barren steppe, stamped with the appearance of having at some remote age been the bed of an extensive inland water-basin, now represented by Balkhash Lake and the two lakes of Ala-kul. With currents becoming more and more sluggish, these seven rivers are bordered by high reeds tenanted by boars, tigers, and other animals; while all around extend arid dunes of sand and salines covered with the characteristic *Anabasis Ammodendron* and other saline flora. Thus only two of the seven rivers reach Balkash, and one of these is the Lepsa.

The Ili, one of the most considerable rivers in Central Asia, separates the Semirechinsk region from that lying more to the south, which the first Russian colonists, in 1854, called the Trans-Ilian country.

In the Trans-Ilian region the traveller is struck by the strongly-marked contrast that exists between the low and hot valley of the Ili and the gigantic snowy Alataù range, extending 35 to 45 miles east and west beyond the river, and which for distinction we term the Trans-Ilian Alataù. The Ili river flows from east to west through a broad valley of about 100 miles in breadth, and of an absolute elevation of more than 1000 feet—a measurement determined by the temperature of boiling water at the Russian ford across the Ili. Its banks are low and perfectly level, and bordered occasionally by high trees of the species *Elaeagnus angustifolia*, *Populus pruinosa* (a peculiar poplar), *Fraxinus* sp. (dwarf elm); also by bushes of the most varied character—the red barberry, *Halimodendron argenteum*; species of the *Astragalus Robinia*, *Tragopyrum*, *Salix*, &c. The breadth of the river is 1050 fathoms English, and has a rapid current. At about 13 miles below the ford it intersects a porphyritic plateau connected with the porphyritic groups of the lower ranges of the Djungarian Alataù. The Ili has eroded a deep bed through this hard porphyry rock, forming picturesque bends between overhanging cliffs. Beyond this romantic defile its banks again become depressed, while the neighbouring country assumes the steppe character of the Balkhash region, its surface becoming covered with sand, salines, and the *Anabasis Ammodendron* and other saline plants. Through this country the Ili flows on for 165 miles until it falls into the Lake Balkhash, where it gives rise to a low delta, overgrown with reeds of impenetrable thickness, in some places of a height of $17\frac{1}{2}$ feet. Above the pass, however, to the very base of the range, the valley of the Ili presents a rich and fertile region, in some places well adapted for permanent occupation, and highly susceptible of cultivation. This is shown by the fact of Chinese penal and military settlements occupying the entire upper portion of the Ili valley, between the Iren-Habirgan and the Tian-Shan, from the junction of the rivers Charyn and Kunurulen upwards to the base of the Bogdo-Ola, in which the Khash and Kunges rivers, tributaries of the Ili, take their rise. The numerous confluents of the Ili flowing from the Iren-Habirgan and the Nan-Shan (the continuations of the Trans-Ilian Alataù) are exhausted before they reach the Ili in watering fields and supplying irrigationary canals. Chinese settlements are thickly scattered throughout the valley; and each village, and every military station, is picturesquely encircled by groves of thick and tall trees planted by the Chinese settlers since the fall of Djungaria, at the latter end of the last century. This proves that the artificial cultivation of timber is possible even in so dry a climate as that of Central Asia. Among the vegetable productions of the Ili valley we may mention the vine, rice, maize, melon, water-melon; and fruit-trees, such as the apricot, pear, apple, plum, &c. Even pomegranate-trees, when carefully sheltered and protected in winter, produce fruit.

Fort Vernoé, the Russian settlement situated in the Ili valley, 47 miles due south from the Ili ford, at the base of the Trans-Ilian Alataù, and at an absolute elevation of not more than 2000 feet, is therefore established under extremely favourable conditions. The Trans-Ilian Alataù, extending from east to west in a direction parallel to the course of the Ili, rises abruptly from the plain like a gigantic wall. From the meridian of the western extremity of Issyk-kul, and almost to the meridian of the eastern extremity of that lake, the entire ridge is covered with perpetual snow. At the centre of this ridge rises the triple-headed giant *Tamarnyn-Tal-Tcheku*, whose altitude I consider scarcely inferior to that of Mont Blanc: from this centre two arms stretch out, gradually dipping until their never-melting snows are lost within the meridians of the extremities of Lake Issyk-kul. Being but slight indentations, the whole of the mountain-passes of this elevated centre of the Trans-Ilian Alataù have an altitude of 8000 to 10,000 feet, and are therefore almost impassable by large detachments of troops. Fort Vernoé is situated at the point where the turbulent and impetuous Almatinka emerges from its mountain-bed: the valley of this river is clad with natural orchards of apple and apricot trees bearing excellent fruit. The settlement, which has been formed by Cossacks and immigrant peasants, already consists of 4000 inhabitants, admirably located. The timber for building-purposes is supplied by the mountain-slopes and transverse valleys, which, at elevations of 4000 to 7500 feet, are overgrown with the Siberian fir. The two Aksai and the two Almatinka streams issuing from the mountain valleys near Vernoé afford an abundant supply of water for irrigation, and have already raised agriculture to a very flourishing condition.

Between the meridians of the extremities of Issyk-kul Lake the Trans-Ilian Alataù consists of two parallel granitic chains, separated by a deep longitudinal valley occupied by depository and metamorphic formations. A transverse knoll likewise covered with perpetual snow connects the two chains at the meridian of the centre of the lake. A longitudinal valley extending to the west of this knoll is watered by the Kebin River, one of the branches of the Tchu, while to the east flows the Tchilik, an affluent of the Ili, and which, emerging on the meridian of the eastern extremity of Lake Issyk-kul, continues its course northwards through a wild transverse cleft of the suddenly depressed northern chain.

The southern chain of the Trans-Ilian Alataù is separated from the higher and parallel range of the Tian-Shan by a deep and extensive hollow forming Issyk-kul Lake, and by the longitudinal valleys of the Tuba and Djirgalan, rivers flowing into Issyk-kul. The plateau, indented by the hollow which contains the waters of Lake Issyk-kul, is situated at an absolute elevation of 4000 feet, and is from 55 to 65 miles wide; while the lake itself with a length of 120 miles has a breadth of 35 to 45 miles. Although the shortest distance from Fort Vernoé to Lake Issyk-kul by way of the Almatin pass across the two chains of the Trans-Ilian Alataù is not more than 60 miles, yet the mountain-passes of the two chains between the meridians of the extremities of Lake Issyk-kul, exceeding 9000 feet in absolute elevation, do not afford convenient access to that lake, and necessitate considerable detours.

When, therefore, in May, 1857, I determined to penetrate into the heart of the Tian-Shan range, I was obliged to choose another way. My caravan consisting of 25 men, 30 horses, and 16 camels, required the selection of the most convenient, and consequently the most circuitous route; the distance to the eastern extremity of the lake could not be estimated at less than 200 miles. The road first extends to the eastward through a valley and along the base of the northern chain of the Trans-Ilian Alataù, crossing the rivers which rise in the latter region trends on until it reaches the Tchilik River, which it passes, turning immediately to the s.s.e., first across the two parallel and inconsiderable ridges in which the northern chain of the Trans-Ilian Alataù becomes gradually merged, and issuing at last on the high plateau of Santash.

The Santash is a high marshy plain, 5500 feet in elevation, disposed at the base of the lower range of the Tian-Shan Mountains. On reaching Santash on the 18th June, we found it still partially covered with masses of snow. Its flora presents a subalpine character, and consists of plants such as the *Leontopodium alpinum*, *Thermopsis alpina*, *Myosotis alpestris*, *Cerastium alpinum*, *Primula nivalis*, *Viola biflora*, &c.

Until the end of June the nights remained cold, with hoar-frost towards morning; while in the warm valley of the Ili where the snow remains two months on the ground, the frost had entirely disappeared, and spring flowers had been in bloom since the latter part of February.

The character of the Santash tableland is marshy; at the very foot of the Tian-Shan lower range occurs a small lake whose light-blue surface is nearly always covered with countless flocks of wild ducks and cranes. On the western edge of the lake we found a pile of stones, raised by human hands, and from which the name of Santash or the "numbered stones," given to the surrounding country, is derived. According to a legend of the Dikokamenni Kirghizes, Tamerlane, on his march eastward, passed by this spot with his troops. Expecting in all probability a speedy engagement with his enemies, and wishing to ascertain the strength of his innumerable host, he directed each warrior to take a stone and deposit it in one place; and thus a colossal heap was soon formed. On their return, the victorious, though partly annihilated, troops of Tamerlane recrossed the Santash plateau. This time the Khan ordered each of his surviving followers to remove a stone from the heap they had raised; and in this manner, the pile assuming its present dimensions, showed the number of warriors who had fallen on the battle-field, and served as a monumental record of their deeds and their memory. The march of Tamerlane from Tamarsk and to the valley of the Ili is not a fabrication. That event occurred at the commencement of the fifteenth century; but the conqueror did not penetrate beyond the lake of Borotal. This interesting legend is historically important, for it fixes the direction of the march of Tamerlane.

The lower ranges of the Tian-Shan or Celestial Mountains rise on the south immediately over the Santash Plateau; but there is not much grandeur in the view from this point, for beyond the foremost, not very elevated mountains, the eye can neither discover the principal range nor its snow-clad summits; small snowy patches appearing only on the more distant peaks. The lower ranges of the Tian-Shan slope rather abruptly towards the Santash Plateau, covered with a luxuriant light-green verdure and bright flowers of the sub-alpine zone. The conifera belong exclusively to the *Picea Shrenkiiusia*; and of the leafy family, the most conspicuous representative is the mountain-ash. The bushy species are numerous, and consist of the mountain-barberry (*Berberis heteropoda*), of several descriptions of the honeysuckle (*Lonicera*), of the tasteless alpine currant (*Ribes alpina*), &c. &c.

The sleek flocks of the Boger Kirghizes were grazing on the rich subalpine meadows of the Tian-Shan, and numerous "auls," or tents of white felt, crowned each hillock and dotted the margin of the lake and surface of the plateau when we approached it. Burambai, the aged chief of the tribe of Bogu, had hastened to meet me the day before with expressions of loyalty towards the Government of Russia. Having three years previously sworn allegiance to Russia, the Bogus received me as the welcome and long-expected representative of the protection they had sought against the inimical and powerful tribe of Sarabagish, by which they had been long oppressed and at last driven, in the spring of 1857, from their hereditary pastures and camping-grounds along Issyk-kul, beyond the Santash to the very borders of China and the great Horde territory. Although I at once endeavoured to persuade Burambai and his Beys that my mission was of a character purely pacific, namely to survey the Tian-Shan and take views, yet they obstinately persisted to regard me in the light of a representative of the power of Russia, whose influence they had already beneficially

felt ; for an exaggerated rumour of the approach of a Russian detachment had caused their hated and dangerous foes, the Sara-Bagish to seek safety in flight beyond the Tian-Shan, abandoning the crops on their fields, and clearing the country they had seized to a distance of 170 miles. Consequently Sultan Tezek, one of the three chiefs of the Great Horde, who had in reality arrived with 800 horsemen to the aid of Burambai, and myself were received as deliverers : a circumstance which greatly facilitated the attainment of the object of my journey.

Two or three days were spent in preparations for the ascent of the Tian-Shan ; and leaving the camels and baggage under guard with Burambai, I left on the 21st June accompanied by an artist, 16 Cossacks and 2 guides of the Bogu tribe, all mounted on fresh horses.

From the Santash Plateau we descended a little towards the Tiub River, which, emerging here from a narrow transverse valley of the Tian-Shan, bends away to the westward at a right angle through a broad longitudinal valley between the Celestial range and the Trans-Ilian Alataù, ultimately reaching Issyk-kul Lake. After fording the impetuous waters of the Tiub, a bridle-path led us up to the Kyzyl-kia, a comparatively low pass over the water-parting between the parallel courses of the Tiub and Djirgalan Rivers. The water-parting abutting here on the lower ranges of the Tian-Shan, extends between the two rivers in a low ridge called Tasma, and at last terminates in Lake Issyk-kul in a low promontory and spit between the mouth of the Tiub and Djirgalan. The Kyzyl-kia, "*Red Road*," is so called from the occasional cropping out of a reddish clay ; no rocky formations were visible. The summits of the Kyzyl-kia are picturesquely clad with copses of the silver-fir, and the view hence, embracing the foremost snow-white ridges of the Tian-Shan, is one of unequalled grandeur. Towards the west, the eye is lost in following the broad and desert valley of the Djirgalan, which notwithstanding its majestic dimensions and frequent bends glistening in the rays of a burning sun, is both dreary and monotonous. The broad plain of the valley has an appearance of aridity and barrenness, due to the scorching effects of the sun ; and with the exception of an interminable uniform row of trees which marks the course of the Djirgalan, and of its affluent the Turgen-Aksu, no woodland occurs to enliven the scene. We frequently met natives in this part of the valley ; but their appearance was not calculated to excite anything like pleasure, for men, women, and children were tattered and pale, and in the last stage of destitution and misery. They were Bogus, who having been captives of the Sara-Bagish had recovered their liberty on the rapid flight of their victors.

The distance from Santash to Turgen-Aksu is reckoned a day's journey, or 20 miles. On the 22nd June we continued our route westward along the dreary valley of the Djirgalan. Crossing three rivers called Djerges, we reached, after travelling 17 miles, the Aksu River, an affluent of the Djirgalan. This river is celebrated among the Dikokamenny Kirghizes for the healing properties of its hot springs, to inspect which I turned off to the southward up its narrow valley. About 3 miles from the point where the river issues from the mountain, the valley divides into two branches ; one, extending to the southward, leads to Altyn-Arassan, the most distant of the two springs ; the other running 3 miles to the s.e. brings the traveller to the nearest or Alma-Arassan spring ; we therefore chose the latter. The path wound gradually up the mountain, bringing into view in the distant western horizon the blue and boundless surface of Issyk-kul Lake with its two characteristic bays and projecting headland. The scenery became gradually wilder and the prospect less extensive ; following the narrow bridle-path we looked down on the swift and foaming river below rushing through its mountain-bed. The outcropping strata were of granitic formation, uplifting strongly inclined layers of mountain-limestone. Dark woods of fir occurred occasionally on the landslips.

Having at last reached the Arassan, we commenced a steep descent towards the river Aksu by a winding path between the most stupendous rocks. The pathway has been with great difficulty cut out of the granite, and is only passable at the hazard of life. The horses had to be led, for the smooth rocks and granite steps rendered their progress both difficult and imminently dangerous. The open space round the spring of Alma-Arassan is not more than 15 fathoms in breadth from the river to the cliff. This warm spring issues from under an immense rock of granite into an elliptical basin 8 feet in length, $3\frac{1}{2}$ in breadth, and 3 to 5 feet deep, from which again it runs in a narrow stream into the cold and impetuous Aksu. I found the temperature of the Arassan Spring at 7 o'clock in the evening to be 40° with an atmospheric temperature of 15° ; that of the Aksu being 11° . The absolute elevation of the spot is about 5400 feet. The spring is surrounded by shady trees, among which we noticed some artificially planted apple-trees, whence the name of the "Apple Arassan." The willow is also there, bending gracefully over the water. Very few bubbles were apparent on the surface of the spring, but a slight smell of sulphuric hydrogen was perceptible. The trees around are considered sacred, and are covered with innumerable rags of every variety of colour, the offerings made by the Dikokamenni Kirghizes to the spirit of the spring. A kind of cavern formed by slabs of granite stands in close proximity. Its interior is low and much dilapidated, and contains benches and an oven. The door of the cavern is of wood, and remarkable for the inscriptions in Thibetian characters which it still exhibits in excellent preservation. The Tian-Shan Arassan spring rises under conditions very analogous to those which produce the springs of Taragatai and of the Djungarian Alataū; namely from the Plutonic series.

On the 23rd June we left the Arassan, losing a horse in the descent. While our little caravan was recovering from the confusion which this loss occasioned, I proceeded alone along the bottom of the Aksu valley, and, following all its sinuosities, at last quitted the foremost ranges of the Tian-Shan. My comrades soon rejoined me, and travelling 27 miles we bivouacked for the night on the Djity-Uguza River, which disembogues in Issyk-kul Lake. The Djity-Uguza takes its rise in a very picturesque transverse valley which opens out an extensive view of the snow-clad summits of the Celestial range. Opposite the very centre of this valley rises the two-peaked Uguz-Bash (bullock's head), clad, like the Yungfrau of the Bernese Alps from its summit to its base in a dazzling white mantle of eternal snow, yet surpassing that mountain in originality of form. To the right of Uguz-Bash we saw a row of rugged black rocks tipped with snow, and belonging probably to the principal range of the Tian-Shan. The broad foaming stream of the Djity-Uguza, strewed with wild rocks, frequently encircles emerald islets covered with a green luxuriant vegetation, forming a landscape of incredible beauty. The thick bushes of the banks and islands of the Djity-Uguza are of the species *Hipophaea rhamnoides*, *Lonicera* (woodbine), *Cotoneaster multiflora*, *Berberis heteropoda* (barberry), *Crataegus* sp. (hawthorn) and wild rose: all interwoven with the *Clematis orientalis*. A broad fertile plain stretches out in all directions, and being easily irrigated, is never allowed by the Kirghizes to be out of cultivation.

On the 24th June we crossed the Djity-Uguza, and shaped our course to the westward. A bridle-path gradually led us up the mountain, leaving on the right the flat and sloping hill of Orgochor, which projects into Issyk-kul Lake in the shape of a promontory. To the north-west and south-west the view spreads out in ever-increasing grandeur: to the north-west the eye could scarcely embrace the blue surface of Issyk-kul, reminding us forcibly of the lake of Geneva; while beyond it rose like a wall the perpendicular southern chain of the Trans-Ilian Alataū, with its small indentations and dazzling patches of perpetual snow. Towards the south-west again the principal chain of the Tian-shan, covered with a broad and brilliant mantle of snow, extends

in endless perspective. The most distant part of the chain being hidden from the traveller by the horizon, appears sinking with its snow-clad heights in the azure waters of the lake.

Ten miles from the Djity-Uguza the bridle-path between Orgochor and the base of the Tian-Shan begins to slope towards the river Kyzyl-Su. Traveling 8 miles farther, we reached the Zaïkù River, where it emerges from the Tian-Shan, and turning to the southwards descended its valley. Beyond a distance of 7 miles the valley bifurcates, its scenery becoming extremely romantic. We were obliged to follow the western branch, or the Zaïkù proper; the eastern is called Zaukuchak. Its picturesque banks are formed by gigantic cliffs of red conglomerate in regularly inclined strata. This locality is called Kyzil-Ungur, or the Red Cavern.

After fording the rapid river below the junction of the two branches, we proceeded to the south-west, along the valley of the Zaïkù. The bridle-path passes under a steep escarpment of red conglomerate, and gradually ascends the elevated left bank of the river, avoiding the overhanging edges of the cliffs. The silver-fir, though frequently occurring on the slopes, is not yet predominant, and the ash, the willow, and the asp still contribute their grace and their foliage. From a south-westerly direction the valley now runs south; syenite replacing the red conglomerate, shows the traveller that he is intersecting the crystalline axis of the foremost chain of the Tian-Shan. Large masses of syenite which had rolled down from the loftier portion of the mountains obstructed the path, and rendered our progress extremely difficult. Three or four miles beyond, the path descended between wild rocks towards a mountain-torrent, fording which we gained the bottom of the valley. The scenery continually increased in majestic grandeur. The valley ascends rapidly and in a straight line towards the Tian-shan, affording a magnificent vista of the snowy summits at its head. The river flows rapidly down its steep bed and glistens in the sun's bright rays. Shady woods of silver-fir come down on either side to the margin of the stream, occasionally forming a broad dark-green barrier across the valley. Above the zone of coniferous trees rise bold ridges of syenite in forms jagged and castellated. Two cascades run down between them in a cloud of spray like the Stambach. The bridle-path along the bottom of the valley twice intersected a thick and impenetrable barricade of coniferae. The stones and rocks are covered with a light green moss of the *sphagnum* species. The flora of the coniferous woods bears a subalpine character, marked by the plants—*Anemone albana*, *Thermopsis alpina*, *Primula longiscapa*, *Doronicum altaicum*, and by several species of the *Pedicularis*, *Glossocomia*, *Speciosa*, &c.

The valley retains the same characteristics for 10 miles beyond Kyzyl-Ungur, where it again divides into two branches. The smallest valley rises under the snowy peaks at the head of a transverse valley of which it is a continuation; while the largest issues from a lateral valley on the w.s.w. We turned into this lateral valley, and, exhausted with fatigue, bivouacked for the night near the upper limit of the coniferae at an elevation of about 7500 feet.

At 5 A.M. of the 25th June the thermometer showed 3° 5' zero. Leaving the greater part of our little caravan behind, and accompanied by Mr. Kosharof, the artist, and by two guides and five Cossacks, mounted on our best horses, I proceeded to ascertain the elevation of the Zaïkù Pass. We journeyed for about 7 miles along the lateral branch of the valley without meeting any obstacles. This part of the valley, extending in a longitudinal direction relatively to the axis of the ridge, is very broad and sloping, and the river flows tranquilly through it. Crystalline formations become succeeded by the sedimentary and metamorphic, and principally by green schist; and timber vegetation, having attained its highest limit, disappears altogether. Seven miles beyond, the scenery again changes. Two branches unite here: the Zaïkù, flowing from the w.s.w. and retaining the same character, and the Kashka-Su, which rushes out of a wild and narrow cross valley. We proceeded along the

latter to the southward, the ascent becoming gradually more frightful and dangerous. The impetuous stream of the Kashka-Su frequently leaps from rock to rock. Continuing our fatiguing ascent for about 3 miles we suddenly emerged on the margin of a beautiful alpine lake of emerald green. Around were piled in crowded confusion the steep escarpments of bare rocks, surmounted at an almost vertical height of 1000 or more feet by the bold indented ridges of perpendicular strata of green schist, perforated occasionally by mountain-streams, falling in silver cascades to give rise to clouds of spray on the rocks below. Behind towered the foremost crystalline chain of the Tian-Shan with its partial covering of snow. Beyond the lake the path began to ascend wild masses of rock, piled up in chaotic disorder, and forming a gigantic barrier across the valley. The character of the vegetation became entirely alpine, the bushy species reaching their limit at an elevation of 9000 feet. The species prevalent are the *Juniperus sabina* and the *Caragana jubata* *aff.*, whose massive prickly branches project all over from between the rocks. Crossing this rocky barrier we came to another alpine lake, situated at a much higher elevation than the last. Being unable to surmount the gigantic rocky barrier described, the Kashka-Su disappears from this lake for about $1\frac{1}{2}$ mile, forcing its way through crevices and clefts below the surface. The water of the upper lake is rather turbid, but the scenery around is grand and imposing. Rocky and gigantic escarpments rise on every side of the lake except on the south-west, where an abrupt landslip of granite heaped together in chaotic confusion occurs, forming a sort of aperture or embrasure high up in the air, through which our narrow zigzag path now led. One of the giant spurs of the Tian-shan projecting from the southward towards the track we were following, terminates in a steep wall and threatens to overwhelm the traveller with its avalanches; while a natural section of its snowy covering shows its annual icy accretion so clearly that had the layers not been so numerous they might have been counted like the concentric rings in a felled tree. The horror of the scene was increased by the countless carcasses of camels, horses, oxen, sheep, goats, and dogs, that strewed the path in every direction. They occurred in thousands between the lower lake of Kashka-Su and the summit of the Zaïkù Pass, stretched in every imaginable posture. This frightful picture of death was in harmony with the sublime though frightful character of the scenery and the icy atmosphere that surrounded us. We were now not more than an hour's journey from the Zaïkù Pass; but the principal difficulties of the ascent were still before us. We were soon enveloped by a cloud of snow; and our horses, trembling with fear, continually stumbled over sharp stones and rocky masses, making a dead stand at the sight of each new carcase. We were at last obliged to dismount, and lead them by the bridle. The artist's horse missed its footing and precipitated its rider, who, however, fortunately escaped with a wound in his leg; my own horse likewise slipped, and cutting itself very severely, bled to death; while two of the Cossacks' animals were so utterly exhausted as to be unable to proceed any farther. And yet we had only performed half the ascent. I was soon compelled to leave behind four Cossacks and a guide; and, accompanied by Mr. Kosharof, a guide, and one of the Cossacks, pressed forward, leading four of our best remaining horses. The guide assured us that the difficulty of breathing at the summit of the Zaïkù Pass was so great that existence beyond half an hour was impossible. At last we attained the object of our journey, and found ourselves on the summit of the mountain-pass, where a landscape of unexpected beauty spread out before us. We now gazed on a vast plain which, extending in every direction from us, formed a kind of broad longitudinal valley between the foremost and main ranges of the Tian-Shan. Directly in front were two lakes, covered with ice already dissolving round their edges. A rivulet flowed tranquilly from one lake to the other, and after emerging from the second, continued its gentle course to the edges of the valley, disappearing suddenly

in the gaping clefts of huge rocky masses, and ultimately reaching the upper lake of Kashka-Su in a cascade of much beauty. Beyond these lakes and some inconsiderable hillocks lay a third lake, the centre of whose surface was likewise covered with ice. Beyond these again rose a chain of snow-clad mountains which seemed no larger than hillocks, so inconsiderable appeared their elevation in comparison to that of the plateau on which we were now standing. These mountains were covered half-way down with never-melting snow. We continued our journey across the valley for 5 miles farther, reaching a third, fourth, and fifth icy lake. The third lake gives rise to a river, which, flowing due south, forces its way through the main chain of the Tian-Shan in a somewhat broad valley, presenting the appearance of an avenue between snowy hillocks. The path ran along this river, passing between snow-clad hills down the southern slope of the Tian-Shan. This river is one of the numerous affluents of the Naryn, and a similar affluent flows out of the fifth lake.

The Syr-Daria is formed by the junction of two rivers, the Naryn and Gutishan. The Naryn is longer than the Gutishan, and its affluents are more easterly. Some of these affluents, therefore, take their rise in the longitudinal valleys between the advanced and main chains of the Tian-Shan, on the northern slope of the latter; just as, farther to the eastward, the affluents of the Sary-Djaza and Aksu rivers, belonging to the water-system of the Tarim, issue from similar valleys, and force their way through the principal chain of the Tian-Shan.

These longitudinal valleys between the chief and outlying chains of the Tian-shan form, therefore, a series of reservoirs which give rise to the rivers of four distinct water-systems of Central Asia, viz., that of the Lobnor and Sea of Aral on the south, and Issyk-kul and Balkhash on the north. The rivers of the two latter systems have to force their way to the north through the advanced chain of the Tian-Shan, while those of the first two pursue their course to the southward through the main chain of those mountains.

Here I found myself in the very heart of Asia, rather nearer to Cashmere than to Semipalatinsk, to Delhi than to Omsk, to the Indian than to the Northern Ocean, and midway between the Pacific and the Euxine, in about $41^{\circ} 4'$ N. latitude; Kunurulen, the astronomical point at the south-western extremity of Issyk-kul, being in $42^{\circ} 17'$ N. The hypsometrical determination gave absolute elevation of 1000 feet for the Zaukü Pass and the affluents of the Naryn; the snow-line prevails about 1000 feet above this elevation. The fire which we kindled cracked and burned unequally; but I experienced no particular oppression in breathing. Around the lake flowers of the most brilliant colours and of the highest alpine zone peeped out from under the newly-fallen and dissolving snow. The flowers were of the species *Ranunculus fraternus*, *Oxygraphis glacialis*, *Dracocephalum alticium*, a few *Pedicularis*, *Draba*, *Chrysosplenium glaciale*, *Hegemone liliacina*, &c.

I very much wished to descend the southern slope of the Tian-Shan, but was obliged to abandon the project, fearing to jeopardize the safety of the party and incur the moral responsibility of any disaster. I therefore turned unwillingly back to rejoin the men below. In two hours we again reached the border of the high plateau, and descended by a fearful path towards the upper lake of Kashka-Su, where we found our four Cossacks comfortably drinking tea round a fire. We had scarcely joined them when suddenly a terrific and rolling noise resembling successive peals of thunder resounded over our heads, causing our Kirghiz guides to flee in all directions. A huge avalanche had descended at a short distance from us, alighting fortunately a little to the side of our encampment. The sun had already set when we arrived at our encampment of the previous day, where we found our tents and the remainder of the Cossacks. On the following morning, 26th June, we descended towards Issyk-kul Lake, and passed the night in a lovely bay near the mouth of the

Kyzyl-Su. Three days after, I stood on the Kungey or northern shore of Issyk-kul Lake, and commenced exploring the high mountain-passes of the southern chain of the Trans-Ilian-Alatau.

My second journey into the heart of the Tian-Shan took me to localities of still greater interest. I succeeded in reaching the majestic and incomparable group of the Khan-Tengri, and the glaciers of the Tian-Shan, whose existence I had previously doubted. But the description of this journey I reserve for a future paper.

LIST OF THE MOUNTAIN-PASSES shown on the accompanying Map.

1. *Djungarian Alatau.*

*1. Tentek ; *2. Lepsa ; *3. Keissyk-Aüs (Hasford) ; *4. Aral-Djoé ; *5. Uigen-Tash ; *6. Altyn-Imel.

2. *Trans-Ilian Alatau.*

*1. Almatin ; *2. Keskelen ; *3. Suok-Tiubé ; *4. Diurenyn ; 5. Koisù ; *6. Oidjeiliäi ; *7. Chin-Bulak ; *8. Djaman-Bastan ; *9. Seirik-Taz ; *10. Turaigir ; *11. Mai-Bulak ; 12. Kudurgù ; *13. Kuremety ; *14. Shaty ; *15. Tad-bulgaty ; *16. Santash.

3. *Tian-Shan.*

*1. Zaùkù ; *2. Kok-Djar ; *3. Tekes-Bash.

The passes visited by the author are marked with an asterisk.

XXV.—*Brief Sketch of the Results of the Issyk-kul Expedition.* By Captain A. GOLUBEF, of the Imperial Staff of Russia. Translated from the Russian by JOHN MICHELL, Esq.)

THE region extending between the Tian-Shan and Altai mountain-ranges and Balkhash plateau, which forms the north-western boundary of the elevated portion of Asia, notwithstanding its great signification in the fate of mankind, has remained hitherto almost a *terra incognita*. It is only the constantly increasing power of Russia in this direction that renders it somewhat accessible to scientific investigation.

Previous to the year 1831, in which was founded the town of Ayaguz, on the right bank of the Ayaguz, the eastern tributary of the Balkhash, we are indebted for all information regarding this region to the learned labours of Humboldt, Ritter, and others. Their information, however, was drawn either from Chinese sources or from the itineraries of traders who had penetrated into Djungaria. Although several European travellers, among whom may be mentioned the Princes Yaroslaf and Alexander Nevski, had visited the northern boundaries of Djungaria during the middle ages, they have not left any records of their journeys; and even if such accounts do exist, they throw scarcely any light on the geography of these parts.

The learned Russian travellers Sivers and Meyer, followed, in 1828, by the great Humboldt, did not penetrate farther than Tarbagatai. But, after the foundation of Ayaguz, the astronomer Fédorof succeeded, in 1834, in reaching the southern shore of Lake Balkhash, at the mouth of the Lepsa. In 1840, 41, and 42, Karelín and Schrenk effected a survey of the Semirechinsk region, a part of Djungaria between the river Ili, Djungarian Alatau, and Lake Balkhash. In 1851 Kovalefski performed a journey to Kuldja—an important result of this mission being the consolidation of friendly relations between Russia and China on the west.

It was not until the construction of Fort Vernoé, in 1855, at the northern